

**CLAIMS**

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1. An antenna device for transmitting and receiving radio frequency waves, installable in a communication device, and comprising:

- 5 - an antenna structure switchable between a plurality of antenna configuration states, each antenna configuration state being distinguished by a set of radiation parameters;
- a switching device which selectively switches said antenna structure between said plurality of antenna configuration states;
- 10 - a first receiver which receives a first measured operation parameter indicative of the quality of transmission of radio frequency waves by said antenna structure;
- a second receiver which receives a second measured operation parameter indicative of the quality of reception of radio frequency waves by said antenna structure; and
- 15 - a control device which controls said switching device, and thus the selective switching of said antenna structure between said plurality of antenna configuration states, in accordance with said received first and second measured operation parameters, so as to improve the quality of at least one of transmission and reception of the antenna structure.
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2. The antenna device as claimed in Claim 1, wherein said control device, at installation of said antenna device in a particular model of communication device, controls said switching device to switch between said plurality of antenna configuration states, in accordance with said received first and second measured operation parameters, so as to adapt said antenna device to suit said particular model of communication device.

3. The antenna device as claimed in Claim 1, wherein said first and second receivers respectively receive the first and second measured operation parameters repeatedly.

4. The antenna device as claimed in Claim 3, wherein said control device, during use of said antenna device in the communication device, controls said switching device to switch between said plurality of antenna configuration states, in accordance with said repeatedly received first and second measured operation parameters, so as to dynamically adapt said antenna device the close-by environment of the communication device.

5. The antenna device as claimed in Claim 1, wherein each of said plurality of antenna configuration states is adapted for use of the antenna device in the communication device in a respective predefined operation environment.

6. The antenna device as claimed in Claim 5, wherein a first antenna configuration state of said plurality of antenna configuration states is adapted for use of the antenna device in the communication device in free space and a second antenna configuration state of said plurality of antenna configuration states is adapted for use of the antenna device in the communication device in a talk position.

7. The antenna device as claimed in Claim 6, wherein a third antenna configuration state of said plurality of antenna configuration states is adapted for use of the antenna device in the communication device in a waist position.

8. The antenna device as claimed in Claim 7, wherein a fourth antenna configuration state of said plurality of antenna configuration states is adapted for use of the antenna device in a radio communication device in pocket position.

9. The antenna device as claimed in Claim 1, wherein said antenna device is arranged for switching frequency bands in accordance with said received first and second measured operation parameters.

10. The antenna device as claimed in Claim 1, wherein said antenna device is arranged for connection or disconnection of diversity functionality, in accordance with said received first and second measured operation parameters.

11. The antenna device as claimed in Claim 1, wherein said control device controls said switching device to selectively switch the antenna structure between said plurality of antenna configuration states, in accordance with at least one of said received first and second measured operation parameters, bypassing a respective threshold value.

12. The antenna device as claimed in Claim 1, wherein

- said control device, in accordance with at least one of said received first and second measured operation parameters, bypassing a respective threshold value, controls said switching device to selectively switch the antenna structure through said plurality of antenna configuration states;

- said first and second receiver receiving a respective first and second measured operation parameter for each antenna configuration state; and

- said control device further controls the switching device to selectively switch the antenna structure to an antenna configuration state with an optimum set of operation parameters.

13. The antenna device as claimed in Claim 1, wherein said control device compares at least one of said received first and second measured operation parameters with a corresponding previously received at least one of first and second measured

operation parameters, and switches the antenna structure, in accordance with the comparison.

14. The antenna device as claimed in Claim 1, wherein said control device includes a look-up table with combinations of received first and second measured operation parameter ranges, each combination being associated with a respective antenna configuration state, said control device adjusting said switching device to the respective antenna configuration state in accordance with said look-up table.

10 15. The antenna device as claimed in Claim 1, wherein the plurality of antenna configuration states comprise different numbers of connected antenna elements.

15 16. The antenna device as claimed in Claim 1, wherein the plurality of antenna configuration states comprise differently arranged feed connections.

17. The antenna device as claimed in Claim 1, wherein the plurality of antenna configuration states comprise differently arranged ground connections.

20 18. The antenna device as claimed in Claim 1, wherein said first measured operation parameter is a measure representing the reflection coefficient of the communication device and said second measured operation parameter is a measure of a received signal strength of the communication device.

25 19. The antenna device as claimed in Claim 18, wherein said antenna device comprises a device which measures the reflection coefficient and sends the reflection coefficient value to the first receiver.

20. The antenna device as claimed in Claim 18, wherein said antenna device comprises a device which measures the received

signal strength and sends the signal strength value to the second receiver

21. The antenna device as claimed in Claim 1, wherein said first and second receivers are provided as a single receiving element.

5 22. The antenna device as claimed in Claim 1, wherein said control device comprises a central processing unit and a memory for storing antenna configuration data.

10 23. The antenna device as claimed in Claim 1, wherein said switching device comprises a microelectromechanical system (MEMS) switch device.

24. The antenna device as claimed in Claim 1, wherein said antenna structure comprises a switchable antenna element having at least one of meander, loop, slot, patch, whip, helical, spiral, and fractal configurations.

15 25. The antenna device as claimed in Claim 1, wherein

- the antenna structure comprises a transmitting antenna structure and a receiving antenna structure; and

- said switching device comprises a transmitter switching device and a receiver switching device,

20 - said transmitting antenna structure and said transmitter switching device being arranged in a transmitter antenna device, and said receiving antenna structure) and said receiver switching device being arranged in a receiver antenna device, wherein

25 - said transmitter antenna device and said receiver antenna device are controllable independently of each other by said control device.

26. A communication device comprising the antenna device of Claim 1.

27. A method for transmitting or receiving radio frequency waves in an antenna device installable in a communication device, the method comprising:

- selectively switching an antenna structure switchable between a plurality of antenna configuration states, each antenna configuration state being distinguished by a set of radiation parameters;
- 10 - receiving a first measured operation parameter indicative of the quality of transmission of radio frequency waves by said antenna structure;
- 15 - receiving a second measured operation parameter indicative of the quality of reception of radio frequency waves by said antenna structure; and
- 20 - controlling said selectively switching of the antenna structure between said plurality of antenna configuration states, in accordance with received first and second measured operation parameters, so as to improve the quality of at least one of transmission and reception.

28. The method as claimed in Claim 27, wherein said controlling includes, at installation of the antenna device in a particular model of communication device, controlling said selectively switching to switch to an antenna configuration state in accordance with said first and second measured operation parameters, so as to adapt the antenna device to suit the model.

29. The method as claimed in Claim 27, wherein said receiving includes repeatedly receiving the first and second measured operation parameters.

30. The method as claimed in Claim 29, wherein said controlling includes, during use of the antenna device in the communication device, controlling said selectively switching between said plurality of antenna configuration states, in accordance with on 5 repeatedly received first and second measured operation parameters, so as to dynamically adapt the antenna device to the close-by environment of the communication device.

31. The method as claimed in Claim 27, further comprising adapting each of said plurality of antenna configuration states 10 for use of the antenna device in the communication device in a respective predefined operation environment.

32. The method as claimed in Claim 27, further comprising switching frequency band in dependence on said received first and second measured operation parameters.

33. The method as claimed in Claim 27, further comprising connecting or disconnecting diversity functionality, in dependence on received first and second measured operation parameters.

34. The method as claimed in Claim 27, wherein said controlling includes controlling said selectively switching the antenna structure between said plurality of antenna configuration states, in accordance with at least one of first and second measured operation parameters, bypassing a respective threshold value.

35. The method as claimed in Claim 27, further comprising:

25 - controlling said selectively switching to switch the antenna structure through said plurality of antenna configuration states, in dependence on the at least one of the first and second measured operation parameters, bypassing a respective threshold value;

- receiving a respective first and second measured operation parameter for each antenna configuration state; and

- controlling said selectively switching to switch the antenna structure to an optimum antenna configuration state.

5 36. The method as claimed in Claim 27, further comprising comparing at least one of received first and second measured operation parameters with corresponding at least one of previously received first and second measured operation parameters, and controlling said selectively switching the  
10 antenna structure in accordance with the comparison.

37. The method as claimed in Claim 27, further comprising storing a look-up table with combinations of received first and second measured operation parameter ranges, each combination being associated with a respective antenna configuration state, and referring to said look-up table for adjusting said selectively switching to the respective antenna configuration state.  
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38. The antenna device as claimed in Claim 1, wherein said set of radiation parameters includes at least one of resonance frequency, impedance, radiation pattern, polarization and bandwidth.  
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39. The method as claimed in Claim 27, wherein said set of radiation parameters includes at least one of resonance frequency, impedance, radiation pattern, polarization and bandwidth.  
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